35 U.S.C. §112, First Paragraph Rejections

Claims 12, 72 and 73 have been rejected under 35 U.S.C. §112, first paragraph, as containing subject matter not described in the specification. The Examiner states that use of biodiesel in claims 12 and 72, and the use of "carbon...eight" in claim 73 is not supported by an appropriate written description in the specification.

Claims 12 and 72 have been amended to remove the term "biodiesel." These claims now include the phrase "an oil of vegetable or animal origin". Although claim 70 did not contain the term biodiesel, it has also been revised for the sake of consistency. It is respectfully submitted, that claims 12 and 72, as amended, satisfy the requirements of 35 U.S.C. §112, first paragraph.

With regard to claim 73, the applicant would like to bring the following paragraph from the specification to the attention of the Examiner:

> Most of these reagents are insoluble in water; therefore, they are normally used in appropriate solvents, which are light hydrocarbon oils and short-chain alcohols whose carbon atom numbers are less than eight. The light hydrocarbon oils include diesel oil, kerosene, gasoline, petroleum distillate, turpentine, naphtanic oils, vegetable oils, etc. (page 16, second paragraph)

The underlined section of the above paragraph clearly identified alcoholic solvents of carbon numbers of less than eight. It is respectfully submitted, therefore, that claim 73 satisfies the requirements of 35 U.S.C. §112, first paragraph.

35 U.S.C. §112, First Paragraph Rejections

Claims 1, 11 and 69 have been rejected under 35 U.S.C. §112, second paragraph, as being "indefinite and for failing to distinctly claim the subject matter that is regarded as invention". In

claim 1, the Examiner considers the term "high" as being vague and indefinite. Applicant respectfully submits that the terms "low" and "high" as used to describe HLB numbers have a well-defined meaning in the art. Applicant has, however, deleted the words "high hydrophile-lipophile balance (HLB)" from claim 1, thereby rendering the rejection moot. Applicant has also added claims 74 and 75, which limit the surfactants that are used for the dewatering of two different types of materials, i.e., oxides, containing oxygens as anions in their crystal structure and those containing sulfur as anions, respectively.

The Examiner noted also that the term "the low HLB surfactant" used in claims 11 and 69 lacks clear antecedent basis. Applicant has replaced the words "the low HLB surfactant" with "said nonionic surfactant." It is respectfully submitted, that claims 1, 11 and 69, as amended, satisfy the requirements of 35 U.S.C. §112, second paragraph.

35 U.S.C. §103 Rejections

Claims 1, 2, 8, 10, 11, 13-15, and 71-73 have been rejected under 35 U.S.C. § 103, as being unpatentable over Yoon et. al. (U.S. Patent No. 5,670,056) in view of Yoon et al. (U.S. Patent No. 5,161,694). The Examiner has suggested that "the addition of a combination of nonionic surfactant and hydrophobic polymers as disclosed in Yoon et al. (056) would appear to increase the hydrophobicity of the particulate material as in the instant process." Also, "the claims differ from Yoon at al. (056) by reciting specific steps for increasing the hydrophobicity of the particulate material with a surfactant and a hydrocarbon oil, respectively". The Examiner argues that: "it is known in the art to add surfactants to mixtures of non-hydrophobic material to render the material hydrophobic, and to add hydrocarbon oil to slurries of hydrophobic material

to aid in coagulating the material." As a basis of his rejection, the Examiner noted that "it would have been obvious to one skilled in the art to modify the process of Yoon et al (056) by addition of the recited surfactant and hydrocarbon oil in view of the teachings of Yoon et al. (694) to increase the hydrophobicity of the particulate material and aid coagulating the material in the slurry". Applicant respectfully traverses this rejection.

There are significant differences between the claimed invention and the cited references. *First*, the claimed invention does not include addition of "a combination of nonionic surfactant and hydrophobic polymers" as disclosed in Yoon et al. (056). The American Heritage Dictionary, College Edition, states that in the field of chemistry, the word "combine" means "to form a chemical compound", and has no connotation for sequencing. In the claimed invention, two different types surfactants are used for initial hydrophobization, followed by a secondary hydrophobization. For the materials consisting of oxygens as anions (e.g., oxides, phosphates, carbonates, silicates, clays or talc), the first hydrophobization is achieved by using surfactants whose HLB numbers are greater than 15, as has been identified in claim 74. The high HLB surfactants are mostly ionic surfactants as noted in several different places of the specification. Yoon et al. (056), on the other hand, disclosed only nonionic surfactants, mostly fatty esters.

For the materials consisting of sulfur atoms as anions, thiol-type surfactants have been identified, as in claims 75 and 76. Thiol-type reagents, which are essential for the initial hydrophobization step of the instant invention, have not been disclosed in Yoon et al. (056).

Second, the two-step hydrophobization process taught by Yoon et al. (694) involves surfactant and hydrocarbon oil, while the claimed invention involves surfactant and non-ionic surfactants whose HLB numbers are less than 15. In the scientific community, hydrocarbon oils

are not regarded as nonionic surfactants. Also, they are not part of the low HLB surfactants of the claimed invention.

With regard to claim 67, which pertains to dewatering of hydrophobic material such as bituminous coal, the Examiner noted that "The specific HLB of the surfactant utilized would have been considered an obvious matter of process optimization to one skilled in the art, depending on the specific slurry dewatered and results desired, absent a sufficient showing of unexpected results." With this, the Examiner suggests that the use of non-ionic surfactants in the second hydrophobization step is an obvious extension of the method of using hydrocarbon oil as described in Yoon et al. (694). Before presenting evidence that low HLB surfactants behaves differently in dewatering processes, it should be noted here that Yoon et al. uses the two-step hydrophobization process to promote the coagulation of hydrophobic particles, while the same is used for dewatering in the instant invention. In the former, the coagulation is an essential step for separating one particulate material (such as ash-forming minerals) from another (such as coal).

Exhibit A below compares the results obtained using diesel (a hydrocarbon oil) and sorbitan monooleate (a low HLB nonionic surfactant) in the second hydrophobization step. The tests were conducted on a fresh bituminous coal sample.

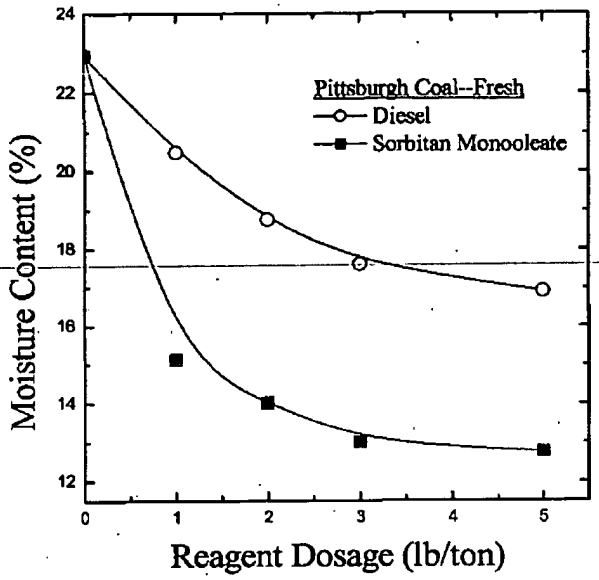

Exhibit A

Comparison of using diesel and sorbitan monooleate as dewatering aids in the laboratory Buchner funnel filtration tests conducted on a Pittsburgh coal sample. The coal sample was taken from the Bailey coal preparation plant, CONSOL Energy. The tests were conducted on fresh sample. The particle size of the coal sample was finer than -0.6 mm. The tests were conducted at 0.6-inch cake thickness, 25-inch Hg vacuum pressure, and 16.4% solids.

As shown, both the diesel and the nonionic surfactant reduced moisture. However, the nonionic surfactant gave much better results than diesel.

Exhibit B below shows the results obtained suing the same coal after letting it oxidize.

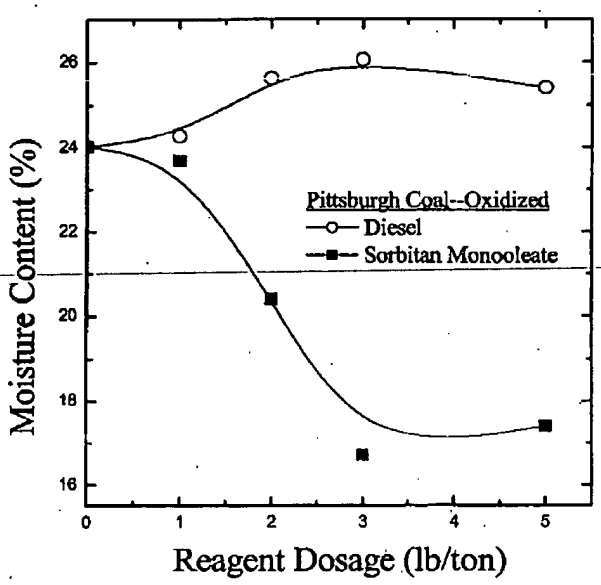

Exhibit B

Comparison of using diesel and sorbitan monooleate as dewatering aids in the laboratory Buchner funnel filtration tests conducted on a Pittsburgh coal sample. The coal sample was taken from the Bailey coal preparation plant, CONSOL Energy. It was oxidized by aging for more than two weeks. The particle size of the coal sample was finer than -0.6 mm. The tests were conducted at 0.6-inch cake thickness, 25-inch Hg vacuum pressure, and 16.4% solids.

With this oxidized coal, diesel actually increased moisture, while the nonionic surfactant was still able to reduce the moisture substantially.

In the specification, the benefit of using low HLB surfactants in the second hydrophobization process has been explained as follows:

> On the less hydrophobic part of the surface, the low HLB surfactants disclosed in the instant invention may adsorb with their polar parts in contact with the surface, possibly *via* acid-base interactions. Such an adsorption mechanism will have the hydrocarbon tails point toward the aqueous phase, and thereby convert the less hydrophobic sites to more hydrophobic ones by covering the sites with

hydrophobes. (page 16, 1st paragraph).

Hydrocarbon oils having no polar groups in its molecular structure cannot adsorb on the hydrophilic part of the surface and increase the hydrophobicity.

Thus, neither Yoon (056) nor Yoon (694) teaches or suggests, either implicitly or explicitly, essential limitations of claims 1 and 67 requiring first and second hydrophobization steps and a nonionic low HLB surfactant in the second step. There is therefore no combination of these references that one could make to achieve the claimed invention.

Claims 8, 14 and 15 have been cancelled, rendering the rejection thereof moot. Claims 2, 10-11, and 13, depend from independent claim 1 and are patentable over the cited references for the reasons discussed above by virtue of their dependency, as well as for other reasons. Claims 68-69, and 71-73, depend from independent claim 67 and are patentable over the cited references for the reasons discussed above by virtue of their dependency, as well as for other reasons. As such, Applicant respectfully submits that the Examiner's rejection of claims 1, 2, 8, 10, 11, 13-15, 67-69 and 71-73 under 35 U.S.C. § 103 as being unpatentable over Yoon et. al. ('056) in view of Yoon et al ('694) should be withdrawn upon reconsideration.

35 U.S.C. §103 Rejections

Claims 12 and 70 have been rejected under 35 U.S.C. § 103, as being unpatentable over Yoon et. al. (056) in view of Yoon et al. (694), and Wang et al. (531). Claim 12 depends ultimately from claim 1 and claim 70 depends ultimately from claim 67. As such, these claims are allowable over the cited references for the reasons discussed above.

In addition, Wang et al. teaches a method of using hydrophilic flocculant, followed by a combination of anionic surfactant and a water-insoluble organic liquid. Although the organic

liquids identified by Wang et al. include the specific oils identified in claims 12 and 70, Applicant respectfully submits that it is not obvious to one skilled in the art to modify the process of Yoon et al. based on Wang et al. *First*, Wang et al. blended anionic (high HLB) surfactants with the recited oils, while the claimed invention requires low HLB surfactants with the recited oils. The former makes the blend more hydrophilic than the latter. *Second*, Wang et al. teaches a method of using a mixture of anionic surfactant and oil after treating a mineral slurry with a flocculant. All of the flocculants identified by Wang et al. are hydrophilic. In the claimed invention, a material is hydrophobized first using appropriate surfactants, i.e., high HLB surfactants for oxides and thiols for sulfides. Thus, the teachings of Wang et al, are opposite of the instant invention in more ways than one.

Applicant respectfully submits, therefore, that the Examiner's rejection of claims 12 and 70 under 35 U.S.C. 103(a) should be withdrawn upon reconsideration.

Comments relative to Paragraph 6 of the Official Action

Applicant has pointed out that "combination of nonionic surfactant and hydrophobic polymer" is not the same as the two-step hydrophobization process developed in the claimed invention. It was argued that combination of Reagents A and B implies forming a new compound or a mixture. Even if it means that Reagents A and B are added sequentially, either the nonionic surfactant or the hydrophobic polymer renders hydrophilic solids hydrophobic. Neither adsorbs readily on hydrophilic materials.

Examiner noted also that "applicant has not presented sufficient factual evidence..." Example 19 given in the specification serves as factual evidence. When a silica slurry was not treated with a high HLB surfactant (dodecyl amine) before adding a nonionic surfactant (sorbitan

monooleate), moisture reductions were minimal. This indicates that sorbitan monooleat (a nonionic surfactant) does not adsorb on hydrophilic surface. The small moisture reduction, as compared to the case of using a high HLB surfactant, was most probably due to a reduction in surface tension.

Examiner suggested that the claimed invention should exclude the use of nonionic surfactants in the first hydrophobization step of the instant invention. Applicant respectfully disagrees for three reasons. *First*, the "combination of nonionic surfactant and hydrophobic polymer" as noted by Yoon et al. (056) does not teach or suggest a two-step process. *Second*, the nonionic surfactants of HLB number less than 15 and hydrophobic polymers do not readily adsorb on hydrophilic oxides and hydroxides, and hydrophobized them. *Third*, in the present application thiols have been claimed for hydrophobizing sulfide minerals during the first hydrophobization step. Some of the thiols such as thionocarbamates and xanthogen formates do adsorb on sulfide minerals and render them hydrophobic. The adsorption mechanism of thiols on sulfide minerals are controlled by chemical reactions and, hence, their HLB numbers or ionicity do not matter significantly. *Most of all*, the nonioinic surfactants identified by Yoon et al. (056) do not include nonionic thiol-type reagents.

Comments relative to Paragraph 7 of the Official Action

In his previous communication, Applicant pointed out that Yoon at al. (056) characterized their chemicals as "water soluble and water dispersible." Examiner responded that "the non-ionic surfactant recited in claim 1 is considered patentably indistinguishable from the low HLB surfactants disclosed in Yoon et al. (056)". Applicant notes that even if the reagents are

indistinguishable, claim 1 requires use of the reagents in two steps, i.e., first hydrophobization step followed by a second hydrophobization step using nonionic surfactants.

Comments relative to Paragraph 8 of the Official Action

Examiner wrote that he carefully considered Examples 19 and 20 but was not convinced that they can be used to overcome the above objections. He seems to believe that they are not generic enough to warrant the instant claims. He wrote that "these conditions included the use of specific surfactants in the dewatering of specific slurries." Applicant disagrees. Example 19 is for silica slurry, while example 20 is for clay slurry. In Example 3, tests were conducted on a zinc sulfide slurry that had been oxidized during transportation. When tests were conducted as received, using sorbitan monooleate, the results were not good. Therefore, tests were conducted after the first hydrophobization step involving sodium isopropyl xanthate (a thiol surfactant). Thus, the three examples noted above used three completely different samples. Yet, there was a commonality that the samples had to be hydrophobized first before the low HLB nonionic surfactant could be effective in dewatering. In fact, a generic statement for the necessity of the two-step hydrophobization process has been made in the Test Procedure section (pages 19-20) of the specification.

Comments relative to Paragraph 9 of the Official Action

In his previous communication dated October 14, 2002, Applicant pointed out that Yoon et al. (056) fails to teach the two-step hydrophobization process. Examiner responded that "addition of a combination of non-ionic surfactants and hydrophobic polymers as disclosed in

Yoon et al. would appear to increase the hydrophobicity of the particulate material as in the instant process."

As noted earlier, the word "combination" does not have the connotation of sequencing of events. Furthermore, the combined product, say a mixture of nonionic surfactant and a hydrophobic polymer, would not adsorb on a material unless the material has been hydrophobized first. The attractive interaction between hydrophobic substances are referred to as "hydrophobic interaction", was the basis of the hydrophobic coagulation process of Yoon et al. (694). On the other hand, the dewatering process of Yoon et al. (056) does not make a reference to the hydrophobic interaction. For this reason, Yoon et al. (056) suggests that their invention "will be useful in dewatering a wide variety of particulate material including coals, clays, sulfides, phosphates, metals, minerals, waste materials, or other particles (col. 4, lines 38-41)." Most of these materials are hydrophilic.

Example 20 of the instant invention showed indeed that the process of Yoon et al. (056) does not work. When a kaolin clay slurry was treated with a low HLB nonionic surfactant (sorbitan monooleate), the moisture was reduced only to 50.4%. When the same clay slurry was treated by the same nonionic surfactant after a first hydrophobization process, as taught by the instant invention, the moisture was further reduced to as low as 28.6%. Such a low level of moisture can never be achieved using "a combination of a nonionic surfactant and a hydrophobic polymer".

Examiner recited Yoon et al. (694), who suggested a method of hydrophobizing a hydrophilic material using a surfactant and further increasing its hydrophobicity by adding a hydrocarbon oil. It is admittedly a two-step hydrophobization process. However, the two-step

hydrophobization process is used for selectively coagulating one-type of hydrophilic particles and separating it from another type of hydrophilic particles. It is not for dewatering. Furthermore, Yoon et al. (694) use hydrocarbon oil rather than a low HLB surfactant for the second hydrophobization step.

Comments relative to Paragraph 10 of the Official Action

In his previous communication dated October 14, 2002, Applicant elaborated the differences between Wang et al. and the instant claims 12 and 70. Examiner refused to accept the differences again by simply suggesting that the applicant's arguments were "based on the propriety of Yoon et al. (056)." Claims 12 and 70 are intended to protect the findings illustrated in Example 18, in which a less expensive hydrophobizing agent can be blended with a more expensive reagent to create a synergistic effect. For unknown reasons, a blend of the two performed substantially better than either of the individual reagent. Also, these claims 12 and 70 are dependent claims of claims 1 and 67, which are diametrically different from Yoon et al. (056) as elaborated in preceding paragraphs. Furthermore, many of the hydrophobicity enhancing reagents identified in the instant invention have not been disclosed in Yoon et al. (056).

Applicant respectfully submits that in light of the foregoing remarks, all of the presently pending claims are now in a condition for allowance. Reexamination and reconsideration are, therefore, respectfully requested.

In the event the Examiner deems personal contact desirable in disposition of this case, the Examiner is respectfully requested to call the undersigned attorney at (603) 668-6560.

A petition for a two month extension of time is enclosed herewith along with form PTO-

2038 authorizing credit card payment in the amount of $205 to cover the extension of time fee. No other fees are believed to be due. However, in the event there are any fee deficiencies or additional fees are payable, please charge them (or credit any overpayment) to our Deposit Account No. 50-2121.

Respectfully submitted,

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Marked Up Copy of Claims Showing Changes Made
USSN 09/327,266; Amend C
May 19, 2003

Claims 8, 14 and 15 have been cancelled without prejudice.

New claims 74-78 have been added

Claims 1, 11, 12, 68-70 and 72 have been amended as follows:

1. (Three Times Amended) A process for dewatering a slurry of hydrophilic particulate material comprising:

initially hydrophobizing said material using a [high hydrophile-lipophile balance (HLB)] surfactant;

adding a nonionic surfactant of HLB number less than 15 dissolved in at least one organic solvent;

agitating said slurry to allow for said nonionic surfactant to adsorb on the surface of said initially hydrophobized material so that its hydrophobicity is further increased; and

subjecting the agitated slurry containing said material to a mechanical method of dewatering.

11. (Twice Amended) The process of claim 1 wherein said nonionic surfactant [the low HLB surfactant] is selected from the group consisting of: fatty acids, fatty esters, phosphate esters, hydrophobic polymers, ethers, glycol derivatives, sarcosine derivatives, silicon-based surfactants and polymers, sorbitan derivatives, sucrose and glucose esters and derivatives, lanolin-based

derivatives, glycerol esters, ethoylated fatty esters, ethoxylated amines and amides, ethoxylated linear alcohols, ethoxylated tryglycerides, ethoylated vegetable oils, and ethoxylated fatty acids.

12. (Three Times Amended) The process of claim 11 wherein said [low HLB] nonionic surfactant is blended with an oil of vegetable[, fish] or animal origin [oil containing triacylglycerides and the biodiesel derived from these oils].

68. (Three Times Amended) The process for claim 67 wherein said particulate material comprises particles of less than 2 mm in size.

69. (Amended) The process of claim 67 wherein said nonionic surfactant [the low HLB surfactant] is selected from the group consisting of: fatty acids, fatty esters, phosphate esters, hydrophobic polymers, ethers, glycol derivatives, sarcosine derivatives, silicon-based surfactants and polymers, sorbitan derivatives, sucrose and glucose esters and derivatives, lanolin-based derivatives, glycerol esters, ethoylated fatty esters, ethoxylated amines and amides, ethoxylated linear alcohols, ethoxylated tryglycerides, ethoylated vegetable oils, and ethoxylated fatty acids.

70. (Amended) The process of claim 67 wherein said nonionic surfactant [low HLB surfactant] is blended with an oil of vegetable[, fish] or animal origin [oil containing triacylglycerols].

72. (Amended) The process of claim 13, wherein said light hydrocarbon oils are selected from diesel oil, kerosene, gasoline, petroleum distillate, turpentine, naphtanic oils, and oils of vegetable [oils, and] or animal origin [biodiesel].